View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Brazilian Journals

Brazilian Journal of Development

Complementary methodology to improvement the acquisition of knowledge about respiratory system

Metodologia complementar para melhorar a aquisição do conhecimento sobre o sistema respiratório

Recebimento dos originais: 18/11/2018
Aceitação para publicação: 20/12/2018

Fabiana América Silva Dantas de Souza
Doutora em Biociência Animal (Biotecnologia Aplicada à Saúde) pela Universidade Federal Rural de Pernambuco
Instituição: Universidade de Pernambuco (Campus Mata Norte)
Endereço: Rua Amaro Maltez, 201, Centro, Nazaré da Mata – PE, Brasil
E-mail: fabiana.americasouza@gmail.com

Rayanne Maria de Lima Oliveira
Graduanda em Licenciatura em Ciências Biológicas pela Universidade de Pernambuco
Instituição: Universidade de Pernambuco (Campus Mata Norte)
Endereço: Rua Amaro Maltez, 201, Centro, Nazaré da Mata – PE, Brasil
E-mail: rayannes245@hotmail.com

Laís Emanuela da Paz Patrício
Graduanda em Licenciatura em Ciências Biológicas pela Universidade de Pernambuco
Instituição: Universidade de Pernambuco (Campus Mata Norte)
Endereço: Rua Amaro Maltez, 201, Centro, Nazaré da Mata – PE, Brasil
E-mail: laisemanuelapp@hotmail.com

Isllane Cristina Tavares da Rocha
Graduanda em Licenciatura em Ciências Biológicas pela Universidade de Pernambuco
Instituição: Universidade de Pernambuco (Campus Mata Norte)
Endereço: Rua Amaro Maltez, 201, Centro, Nazaré da Mata – PE, Brasil
E-mail: atrd16jan@hotmail.com

Jankeles Richelle da Silva
Graduando em Licenciatura em Ciências Biológicas pela Universidade de Pernambuco
Instituição: Universidade de Pernambuco (Campus Mata Norte)
Endereço: Rua Amaro Maltez, 201, Centro, Nazaré da Mata – PE, Brasil
E-mail: islanelanyc@outlook.com

ABSTRACT

Alternative and practical classes are effective in assisting teachers and students in the teaching-learning processes, aiming at good examples in the construction of knowledge, serving as a complement to traditional classes, which in most cases become exhausting due to lack of investment and innovation. The respiratory system is of great importance for human life as it is responsible for the absorption of oxygen through the airways and lungs. Observing the difficulties faced by teachers in the classroom due to limited resources within the school, this work had the objective of implementing an alternative methodology to improve the acquisition of knowledge about biophysics of the respiratory system. The research was carried out with a group of the 3rd year of High School of the Aluísio Germano School in the city of Carpina - PE. Two identical

Brazilian Journal of Development

questionnaires were applied: one after the traditional class and another after the alternative class with the application of the Quiz game. The results indicated that there was a considerable increase in the correctness of the questions in the second questionnaire compared to the first one. In addition, it was observed that, during the class that used the game, the students showed more interest in knowing and learning about the subject, having an increase of interaction and totaling 85% the level of interaction in the proposed activities, which corroborates with other authors in the literature. In this way, it was noticeable that the use of playful resources associated with the practices can be great allies in the teaching-learning process.

Keywords: Respiratory system; Alternative methodology; Pedagogical practice.

RESUMO

Aulas práticas e alternativas são efetivas na assistência a professores e alunos nos processos de ensino-aprendizagem, visando bons exemplos na construção do conhecimento, servindo como complemento às aulas tradicionais, que na maioria das vezes se tornam desgastantes devido à falta de investimento e inovação. O sistema respiratório é de grande importância para a vida humana, pois é responsável pela absorção de oxigênio pelas vias aéreas e pulmões. Observando as dificuldades enfrentadas pelos professores em sala de aula devido aos recursos limitados dentro da escola, este trabalho teve o objetivo de implementar uma metodologia alternativa para melhorar a aquisição de conhecimentos sobre a biofísica do sistema respiratório. A pesquisa foi realizada com um grupo do 3º ano do Ensino Médio da Escola Aluísio Germano, na cidade de Carpina - PE. Dois questionários idênticos foram aplicados: um após a aula tradicional e outro após a aula alternativa com a aplicação do jogo Quiz. Os resultados indicaram que houve um aumento considerável na correção das questões do segundo questionário em relação ao primeiro. Além disso, observou-se que, durante a aula que utilizou o jogo, os alunos mostraram mais interesse em conhecer e aprender sobre o assunto, tendo um aumento de interação e totalizando 85% do nível de interação nas atividades propostas, o que corrobora com outros autores na literatura. Dessa forma, percebeu-se que o uso de recursos lúdicos associados às práticas pode ser um grande aliado no processo de ensino-aprendizagem.

Palavras-chave: Sistema respiratório; Metodologia alternativa; Prática Pedagógica.

1 INTRODUCTION

It is common to realize that many teachers use only traditional classes to transmit knowledge, so biology and science classes become methodical and tiring, causing individuals to dislike the discipline and the contents taught. In the classes that study the physiology and functionality of the organs, in the absence of corpses or 3D virtual anatomical table, it will be necessary complementary materials such as prototypes, artificial representations of the human body, illustrative games that will be stimulate the student's critical hinking and facilitate their learning (AMARAL et al., 2015; CARDOZO et al., 2016).

The didactic games and practical classes used as methodology for the benefit of the learning cause different effects in several aspects, as in the student's performance, in the engagement and the motivation in search of knowledge. (VLACHOPOULOS, MAKRI, 2017), besides being strategies that bring understanding, problem solving, develops psychic abilities and favors socialization,

contributing to the acquisition and absorption of knowledge, thus improving the interaction between teacher and student body (STOFFOVÁ, 2016)

The playful is an instrument that, when well implemented, is capable of providing surprising results, since it facilitates the building of knowledge and interpersonal relationships, besides stimulating cognition, and conferring the association with a feeling of pleasure and satisfaction in learning (SCHWARZ, 2006; COSTA, 2012).

Generally, the contents of the discipline of biology are very extensive and have several words and concepts with complex scientific denominations, which makes it difficult to establish the knowledge about these subjects by the students, especially those high school students of the public schools who present more frequently a difficulty in understanding the terms of biology, this is due to the lack of resources in Brazilian public education institutions. However, the development of practical activities in the classroom, when well used by the teacher, allows the memorization of definitions that were not perceived by the students during the theoretical classes (ALVES, et al., 2010; BARBÃO and OLIVEIRA 2010). In view of these obstacles, the objective of this work was to implement an alternative methodology to improve the acquisition of knowledge about respiratory system biophysics.

2 METHODOLOGY

The research was carried out at the Aluísio Germano School, located in the municipality of Carpina, PE, in a class of the 3rd year of regular high school with 34 students. The Carpina Municipality is part of the Zona da Mata of Pernambuco, Brazil (Figure 1).

Figure 1. Map of the Municipality of Carpina-PE. SOURCE: Google

First, a traditional class was ministered about biophysics of the respiratory system, after which a questionnaire with ten multiple choice questions was applied (Figure 2A), in order to analyze the effectiveness of the methodology. Then, the alternative class was ministered, and the game called "Respiratory System Quiz" was applied. Finally, the questionnaire was applied again

with the same questions and alternatives, but with the different order (Figure 3), to verify how much the playfull methodology contributed to the absorption of the content.

In class about the respiratory system biophysics, we presented the mechanical and chemical processes involved in breathing, the interrelation of inspiration and expiration, involving the contraction and relaxation of the diaphragm and the intercostal muscles stimulated by the nervous system, was approached still some animals in which the respiratory surface is the body's own lining, or is located in specific regions of the body, forming organs (gills and lungs) specialized in absorbing oxygen gas and eliminating carbon dioxide (AMABIS and MARTHO 2010).

The alternative methodology used was similar to a Quiz Game, containing questions and answers related to the subject matter, students were divided into two groups, A and B (Figure 2C), and each group received two boards written with Yes and No, made from cardboard, and straw (Figure 2B), the game worked as follows: for every sentence shown on the Power Point slide show, a representative of the group would pick up the board saying if it was correct or not. The affirmations used in the "Respiratory System Quiz" were elaborated based on the ministreded class , these affirmations were answered with "Yes" or "No", to guarantee the participation of all, the groups responded alternately

Phrases corresponding to the correct answers used in the game: "Respiratory System Quiz":

1- The entrance of the larynx is called the glottis, above this glottis there is a tongue of cartilage, the epiglottis, which functions as a valve, when we swallow, the larynx rises and its entrance is closed by the epiglottis, preventing the swallowed food from entering its respiratory tract and cause choking. **(YES)**
2- Both the trachea and the bronchi and bronchioles are clad externally by a ciliated epithelium, rich in mucus-producing cells **(NO)**
3- The alveoli are covered by blood capillaries, in which the blood circulates very close to the air that penetrates the alveoli, these surroundings does not cause diffusion of gases between the blood and the air.. **(NO)**
4- The process called pulmonary ventilation is the exchange of gases within the alveoli. **(NO)**
5- During inspiration, the contraction of the intercostal muscles and the diaphragm occurs, air enters the lungs and a decrease in the internal pressure in relation to the external pressure. **(YES)**
6- At the expiration, there is relaxation of the intercostal muscles and the diaphragm, airflow in the lungs and an increase in the internal pressure in relation to the external one. **(YES)**

7- From the nervous center depart the nerves responsible for stimulating the concentration of respiratory muscles. **(YES)**

8- Voluntary breathing control can cause people who are fainting and are at risk of drowning to voluntarily inhale water and end up dying due to water entering the lungs. **(NO)**

9- The diffusion that occurs in hematosis occurs in the bronchi. **(NO)**

10- Oxyhemoglobin is a complex formed by the association of oxygen and hemoglobin. **(YES)**

11- Most of the carbon dioxide from the cellular respiration will associate with hemoglobins forming the carbohemoglobin. **(YES)**

12- H^+ and bicarbonate ions are formed by the dissociation of carbohemoglobin. **(NO)**

13- Carbonic acid transforms at H + ions, these leave the red blood cells and go to the blood plasma, whereas bicarbonate ions associate with hemoglobin. **(NO)**

14- Before diffusion occurs, the air that is present in the alveoli is rich in CO_2 and the blood in the capillaries is rich in O_2. **(NO)**

15- After the carbonic acid is converted to CO_2 and water, this CO_2 diffuses into the alveolar air and is eliminated by expiration. **(YES)**

Brazilian Journal of Development

Figure 2. (A) Application of the questionnaire in the 3rd grade class; (B) Boards used in the Respiratory System Quiz; (C) Students participating in the Respiratory System Quiz.

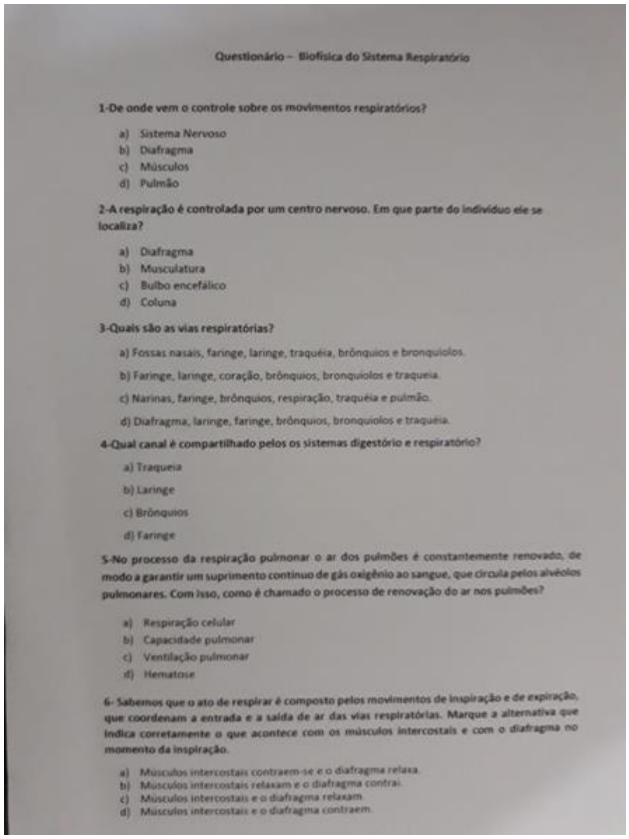
A

B

C

Brazilian Journal of Development

Figure 3. Questionnaire used in the evaluation of learning.



Questionário – Biofísica do Sistema Respiratório

1-De onde vem o controle sobre os movimentos respiratórios?

a) Sistema Nervoso
b) Diafragma
c) Músculos
d) Pulmão

2-A respiração é controlada por um centro nervoso. Em que parte do indivíduo ele se localiza?

a) Diafragma
b) Musculatura
c) Bulbo encefálico
d) Coluna

3-Quais são as vias respiratórias?

a) Fossas nasais, faringe, laringe, traquéia, brônquios e bronquíolos.
b) Faringe, laringe, coração, brônquios, bronquíolos e traqueia.
c) Narinas, faringe, brônquios, respiração, traquéia e pulmão.
d) Diafragma, laringe, faringe, brônquios, bronquíolos e traquéia.

4-Qual canal é compartilhado pelos os sistemas digestório e respiratório?

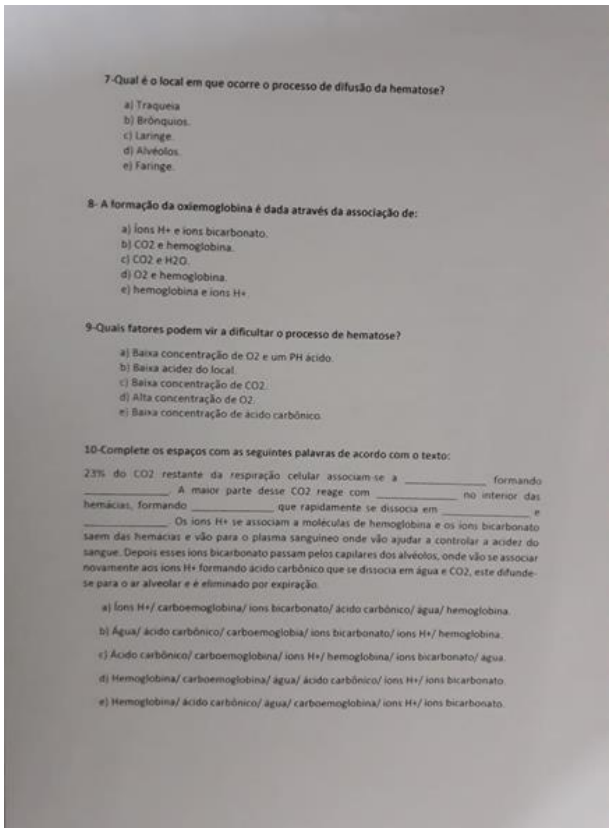
a) Traqueia
b) Laringe
c) Brônquios
d) Faringe

5-No processo da respiração pulmonar o ar dos pulmões é constantemente renovado, de modo a garantir um suprimento contínuo de gás oxigênio ao sangue, que circula pelos alvéolos pulmonares. Com isso, como é chamado o processo de renovação do ar nos pulmões?

a) Respiração celular
b) Capacidade pulmonar
c) Ventilação pulmonar
d) Hematose

6- Sabemos que o ato de respirar é composto pelos movimentos de inspiração e de expiração, que coordenam a entrada e a saída de ar das vias respiratórias. Marque a alternativa que indica corretamente o que acontece com os músculos intercostais e com o diafragma no momento da inspiração.

a) Músculos intercostais contraem-se e o diafragma relaxa.
b) Músculos intercostais relaxam e o diafragma contrai.
c) Músculos intercostais e o diafragma relaxam.
d) Músculos intercostais e o diafragma contraem.



7-Qual é o local em que ocorre o processo de difusão da hematose?

a) Traqueia
b) Brônquios.
c) Laringe.
d) Alvéolos.
e) Faringe.

8- A formação da oxiemoglobina é dada através da associação de:

a) Íons H+ e ions bicarbonato.
b) CO2 e hemoglobina.
c) CO2 e H2O.
d) O2 e hemoglobina.
e) hemoglobina e ions H+

9-Quais fatores podem vir a dificultar o processo de hematose?

a) Baixa concentração de O2 e um PH ácido.
b) Baixa acidez do local.
c) Baixa concentração de CO2.
d) Alta concentração de O2.
e) Baixa concentração de ácido carbônico.

10-Complete os espaços com as seguintes palavras de acordo com o texto:

23% do CO2 restante da respiração celular associam-se a _____ formando _____. A maior parte desse CO2 reage com _____ no interior das hemácias, formando _____ que rapidamente se dissocia em _____ e _____. Os ions H+ se associam a moléculas de hemoglobina e os ions bicarbonato saem das hemácias e vão para o plasma sanguíneo onde vão ajudar a controlar a acidez do sangue. Depois esses ions bicarbonato passam pelos capilares dos alvéolos, onde vão se associar novamente aos ions H+ formando ácido carbônico que se dissocia em água e CO2, este difunde-se para o ar alveolar e é eliminado por expiração.

a) Íons H+/ carboemoglobina/ ions bicarbonato/ ácido carbônico/ água/ hemoglobina.
b) Água/ ácido carbônico/ carboemoglobia/ ions bicarbonato/ ions H+/ hemoglobina.
c) Ácido carbônico/ carboemoglobina/ ions H+/ hemoglobina/ ions bicarbonato/ agua.
d) Hemoglobina/ carboemoglobina/ água/ ácido carbônico/ ions H+/ ions bicarbonato.
e) Hemoglobina/ ácido carbônico/ água/ carboemoglobina/ ions H+/ ions bicarbonato.

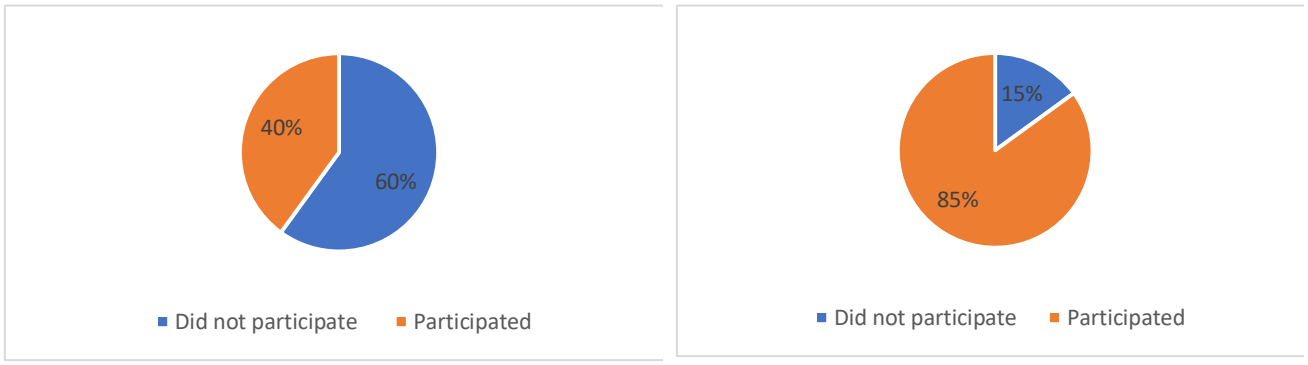
3 RESULTS AND DISCUSSION

The results showed that most of the students, more specifically 60%, did not act in a participatory manner during the traditional class, leaving only 40% of the class interested to question in class (Figure 4A). However, when used to the alternative methodology, using the game "Quiz of the Respiratory System", a significant difference was observed in the participation of the students. It was verified that there was an increase of 25% of participatory students, totaling 85% of the class (Figure 4B)

Brazilian Journal of Development

Figure 4 - Comparative chart between the participation of the students in the traditional class (A) and in the class using alternative methodology (B)

A **B**



After the first stage, with the traditional lesson on the respiratory system, and the application of the first questionnaire, it was noticed that the students presented difficulties regarding the issue of number 6, which was about the essential movements of breathing, contraction of the intercostal muscles and of the diaphragm; and issue number 8, which addressed the place where the key process of respiration, called diffusion, occurs.

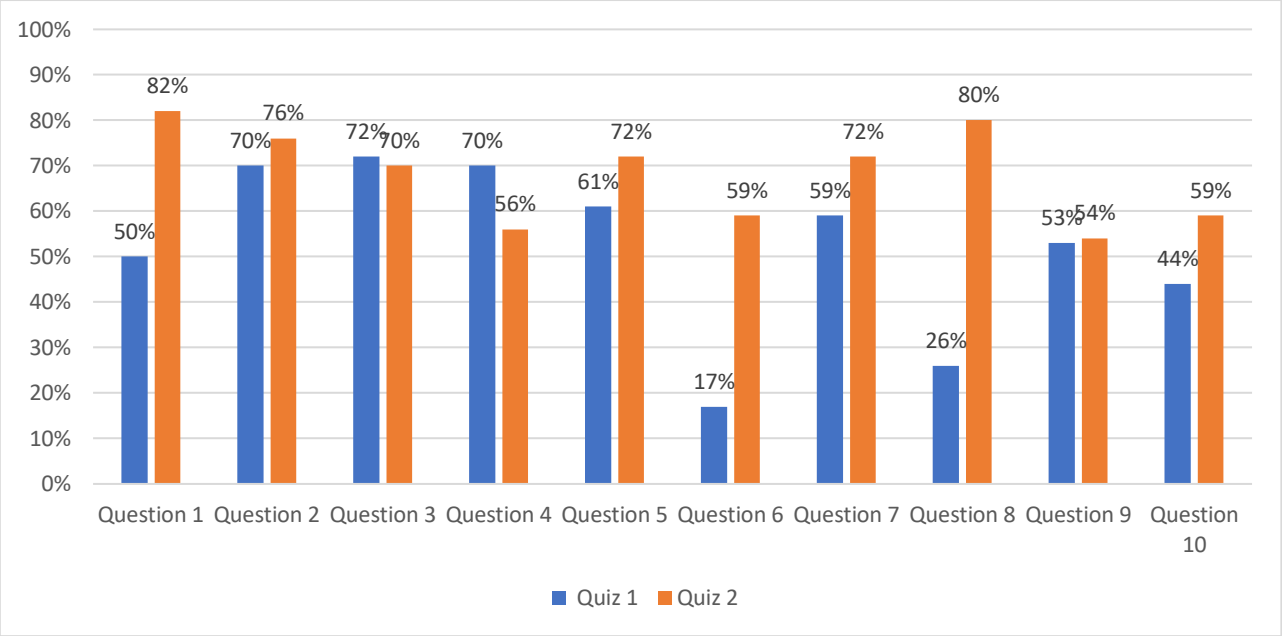
The traditional class did not stimulate students to acquire new information about the content presented, which generated concern, since the important thing would not only be to make them learn, but also to generate in them the interest so that alone they could seek new information and become active in the learning process. As with this work, Cardozo et al., 2016, report the students' lack of motivation regarding the teaching of science developed in schools, and reinforces the importance of new alternative practices to improve the relationship between the student and the object of study, as well as the harmony between teacher-student, student-student and the classroom environment as a whole.

In the second stage, after the alternative methodology using the game "Quiz of the respiratory system", the second questionnaire was applied, and it was verified that there was a positive difference in relation to the first questionnaire applied after the traditional class. In relation to questions 6 and 8, there was a significant increase when compared to the number of correct answers in the first questionnaire. The results of this work also resemble those of ITEN and PETKO (2016), who argue that play activities are well used when starting new content, since they contribute to motivation during the teaching-learning process.

The results of both comparative questionnaires show that there is a significant difference between a content taught in the traditional class and wtih the subsidy of an alternative practical class (Figure 5). In view of the above, it was confirmed how important it would be for teachers to

incorporate practices with alternative classes in addition to traditional classes, since, it helps students to learn in an active and spontaneous way..

Figure 5 - Comparative chart referring to the quantitative of correct answers by question of the first and second evaluation questionnaires.



In this way, through the contact with the complementary play methodology, the students obtained a broader and clearer understanding, intensifying, thus, the evidences of previous researches, where they show that the practices dynamically help the contents lived in class, contributing to the improvement of the students' understanding and interaction (CARDOZO et al., 2016).

4 CONCLUSION

The use of alternative methodologies involving playful resources associated to innovative practical classes aimed at the acquisition of new knowledge in a simple, relaxed and productive way, should always be inserted as a complementary tool to the learning disposition. The dynamism of the practical classes is a great tool that the teachers have in their favor, to complement the theoretical classes in the classroom.

The alternative classes related to the biological sciences do not necessarily have to be in the laboratory or inside the classroom, better classes can be carried out with few resources, using materials of low cost and of the own daily of the students, enriching the learning.

The game "Quiz of the Respiratory System" was an example of innovation, because, it has provided the strengthening of the students' learning without using resources unusual to the reality. The execution of the game contributed to a more dynamic and attractive class, helping in the fixing of the content, besides raising considerably the interest and the interaction of the students.

REFERENCES

ALVES, P. C. S. et al. **Desenvolvimento de atividade lúdica para o auxílio na aprendizagem de citologia: Baralho das organelas citoplasmáticas.** Revista da SBEnBio, n. 03, p.4085-4101, 2010.

AMARAL et al. **Transfusion game, a playful resource for teaching nursing students Hemotherapy**. Revista Práxis, Ano VII, n. 13, 2015.

AMABIS, JOSÉ MARIANO; MARTHO, GILBERTO RODRIGUES. **Volume 2: Biologia dos organismos** – 3. Ed. – São Paulo: Moderna, 2010.

BARBÃO AJM, OLIVEIRA IG. **Utilização e compreensão da nomenclatura biológica por alunos do ensino médio da escola estadual Wilson de Almeida – Nova Olímpia/MT.** In Anais do IV Fórum de educação e diversidade: "diferentes, (desiguais e desconectados).”; 13 a15 de junho de 2010. Tangará da Serra, MT. Livro Digital IV Fórum de Educação e Diversidade. 2010. p 1-5.

CARDOZO, L. T; MIRANDA, A. S; MOURA, M. J. C. S; MARCONDES, F. K. **Effect of a puzzle on the process of students’ learning about cardiac physiology**. Adv Physiol Educ n. 40, p. 425–431, 2016.

ITEN, N.; PETKO, D. **Learning with serious games: Is fun playing the game a predictor of learning success? -** British Journal of Educational Technology (2016) p. 161-163, 2016.

ICEEPSY 2016: 7th **International Conference on Education and Educational Psychology**. eISSN: 2357 -1330 2016.

SCHWARZ, V. R. K. **Contribuição dos jogos educativos na qualificação do trabalho docente.** Porto Alegre, RS, 2006. 93p. Dissertação (Mestrado em Educação em Ciências e Matemática) Pontifícia Universidade Católica do Rio Grande do Sul, PUCRS, 2006

STOFFOVÁ, V. **The Importance of Didactic Computer Games in the Acquisition of New Knowledge.** The European Proceedings of social & Behavioural sciences.

VLACHOPOULOS and MAKRI. **The effect of games and simulations on higher education: a systematic literature review**. International Journal of Educational Technology in Higher Education v. 14, n. 22 P. 2-33 and 14-33, 2017.